# Terminator 5 Unified Wire Engine

## 2x40GbE/4x10GbE, PCIe Gen3, SR-IOV, TCP/IP, UDP/IP, iSCSI, FCoE, iWARP RDMA Offload

## Features

- PCI Express Gen3 x8 host bus
- Quad port 100M/1G/10G and dual port 40G
- Integrated KR4, KX4, CX4, KX, KR, SGMII support
- I$^2$C, SMBus, IPMI 2.0 management interface
- Comprehensive Stateless Offloads
- Full TCP Offload and Microsoft TCP Chimney
- Low latency UDP Offload Engine
- Multicast Offload Engine™
- iSCSI Full Offload or PDU Offload
- FCoE Full Offload or PDU Offload
- Network Address Translation (NAT) Offload
- Low latency iWARP RDMA Offload
- Line rate Firewall Offload™
- Media/Video Stream Engine™
- iSCSI Routing™ and TCP Proxy™
- Integrated Ethernet switching and routing
- Extensive virtualization support
    - 128 VF, 8 PF SR-IOV support
    - Integrated 140-port virtual switch
    - VEB/VEPA/Flex10/VNTAGs support
    - Offloaded 802.1 Qbg/h support
- DCB (CEE) support
- Packet tracing and sniffing
- IEEE 1588 Offload (PTP)
- Fine grain timestamps with PTP Integration
- Mem-free operation capability
- Software compatible with T4
- FCBGA 31x31mm package

## Benefits

- Scalable to 1 million connections
- High performance architecture
- Unified Wire interconnect solution for server networking, storage networking and compute clustering on a single fabric
- Designed and tuned for low latency, high packet rate and high bandwidth
- Enables flexible 40G/10G/1G combinations
- Reduces host CPU utilization by up to 95%
- Highly programmable and manageable solution
- Robust, stable and proven fifth generation technology

## Applications

- Networking – TCP & UDP Offload, IPv4 and IPv6
- Storage – iSCSI & FCoE
- High performance computing – RDMA & user-space I/O
- Security and firewalls
- Network analytics and monitoring
- Web 2.0 and load balancing
- Virtualization and multi-tenancy
- Network traffic management
- Rich media streaming
- Application servers
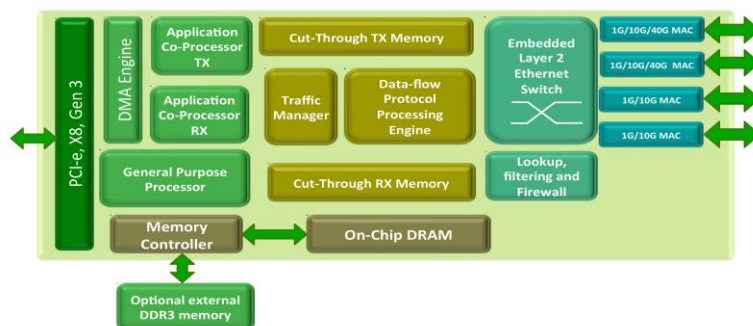


**Terminator 5 Block Diagram**

## Specifications

### Host Interface

- PCI Express Gen3 x8
- MSI-X, MSI and legacy pin interrupts

### Network Interfaces

- Two 40G ports
- Four 10G/1G/100M ports
- One 40G and three 10G/1G/100M ports independently configurable
- Two 10G and two 1G/100M ports independently configurable
- Two ports exposed with KR4, KX4, CX4, KX, KR, SGMII
- Two ports exposed with KX, KR & SGMII

### Ethernet

- IEEE 802.3ae (10GbE)
- IEEE 802.3az Energy Efficient Ethernet
- IEEE 802.3z (1GbE)
- IEEE 802.1p Priority
- IEEE 802.1Q VLAN tagging
- IEEE 802.1Qbg EVB/VEPA
- IEEE 802.1BR Bridge Port Extension
- IEEE 802.1Qau Congestion Notification
- IEEE 802.3x Flow Control
- IEEE 802.3ad Load-balancing and Failover
- Ethernet II and 802.e encapsulated frames
- IEEE 802.3ba (40GbE)
- Multiple MAC addresses per interface
- Jumbo Frames up to 9.6 Kbytes

### Stateless Offloads

- TCP/UDP checksum offload for IPv4 & IPv6
- Flexible receive side steering for IPv4 & IPv6
- Large/Giant Send Offload (LSO) for IPv4 & IPv6
- VLAN filtering, insertion & extraction
- Line rate packet filtering and attack protection
- Fine granularity time stamping (2 nsec)
- Ethernet Routing (packet header rewrite)
- Packet Tracing and Packet Sniffing

### TCP/IP Full Offload

- Full TCP implementation including exceptions – IPv4 & IPv6
- Extensive RFC compliance, fully featured stack
- Full TCP Proxy between any set of connections (encapsulation, bridging)
- Direct Data Placement
- 1 million simultaneous connections

### Firewall Offload™

- Rule-based packet steering and filtering capability
- Tens of thousands of steering and filtering rules
- Flexible drop/steer/switch & rewrite actions

### High Availability

- Port Bonding with failover between and across cards for all modes NIC/TOE/iSCSI/iWARP/FCoE
- T10-DIF and DIX extensions

### iSCSI Offload

- Full iSCSI initiator and target mode stack
- T10 DIF/DIX support
- CRC32C offload generation & verification
- Direct Data Placement
- iSCSI proxy switching based on SCSI CDB

### FCoE Offload

- Full offload HBA FCoE (Initiator or Target)
- T10 DIF/DIX support
- Open-FCoE Offload (Initiator)
- CRC32 offload generation & verification
- Ingress & Egress ACL (Access Control List)
- Direct Data Placement

### High Performance RDMA

- 1.5 μsec latency, line rate bandwidth
- iWARP support in Linux OFED
- Microsoft Network Direct support
- Native support for Windows Server 2012-R2, 2016, Azure Stack, Storage Replica, Storage Spaces Direct, Client RDMA, SMB-Direct
- NVMe over Fabrics
- Support for NFS-RDMA, Lustre-RDMA, NVIDIA's GPU-Direct, Hadoop-RDMA
- Socket user-space I/O (TCP and UDP, raw Ethernet)

### UDP & Multicast Offload

- UDP Sockets API
- 1.5 μsec user-to-user latency
- Multicast replication on ingress or egress

### Virtualization

- VMQueue and NetQueue support
- NVGRE & VxLAN
- PCI-SIG SR-IOV, 128 VFs/8PFs
- Multicast/broadcast replication

- 1.5 μsec latency, line rate bandwidth
- VLAN support up to 4096 VLAN IDs
- Load balancing and Fail-over capabilities

- VEB, VEPA, Flex10
- 512 MAC addresses
- Complete statistics per VF

### StreamEngine™
- Up to 32K streams
- Multiple simultaneous transmit rates
- Precise rate control minimizes jitter
- Video segmentation offload with RTP support

### Physical and Environmental
- Fully RoHS Compliant
- Operating Temp: 0° to 55° C or 32° to 131° F
- Operating Humidity: 5 to 95%
- Airflow: 200 lf/m

**Sales Contact**: sales@chelsio.com
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**Ordering Information**:

| Part Number | Description | Package | Ball Count | Power |
|---|---|---|---|---|
| T5ASIC40G | T5 Unified Wire Engine, 2x40G or 4x10G ports | 31x31mm | 899 | 13W |
| T5ASIC10G | T5 Unified Wire Engine, 4x10G ports | 31x31mm | 899 | 10W |
| T5ASIC40G-SO | T5 Server Offload Engine, 2x40G or 4x10G ports | 31x31mm | 899 | 9W |
| T5ASIC10G-SO | T5 Server Offload Engine, 4x10G ports | 31x31mm | 899 | 8W |

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